126 Blood pressure determinations were
141 made by the senior author at least three times during each interview, at five
124 minute intervals. Heights and weights were also determined. Interviews were conducted in the homes of respondents.

124 It was hoped at the outset that each adult member of the three Washo
114 communities of Dresslerville, Woodfords and Carson City would be included in the survey. However, the pressures of time limited the series to 100 persons, representing approximately 50% of the adult population of these three communities. All but two or three of the Washo contacted agreed to participate in the study. Nonetheless, the possibility that the interviewed group was biased in some manner, such as being more geographically accessible and therefore socially "different" from non-contacts, suggests that results be interpreted with caution.

147 For the analysis that follows, a diastolic blood pressure, taken during
128 the initial interview, of 90 mm. Hg. or more was defined as an indication of hypertension. Tests of significance used in the analysis are based on Chi squares or T-tests. Findings significant at or beyond the 10% level of confidence are reported.

Results

147 The mean blood pressure levels of the Washo studied are set out in
158 Table I by age and sex. It will be noted that in this sample blood pressure increases with age, that the males have higher pressures in the younger ages and the females higher pressures in the older ages. Further, Washo blood pressures are high in terms of the criterion traditionally used as an indication of hypertension -- a reading of 90 mm. Hg. or more for the diastolic -- as indicated by the fact that the mean pressures, particularly of the older groups, are either very close to, or above, the upper limits of "normal."

TABLE I

Mean Blood Pressures, by Age and Sex,
for Washo Indians

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Age	Males	N	Females	N
25 and below	124/79	(5)	119/78	(13)
26 - 45	137/90	(19)	122/78	(20)
46 - 65	133/89	(13)	146/88	(13)
66 and above	157/91	(8)	158/90	(9)
TOTAL	138/91	(45)	132/82	(55)

Nine variables were selected for analysis in terms of their relation to the presence or absence of hypertension. Six of the nine were associated with hypertension at, or better than, the 10% level of significance: 147 158 121

1. Age. Increasing age was associated with an increase in the percentage of elevated blood pressures.

2. Sex. Males have a higher percentage of elevated pressures than do females.

3. Obesity. Using standardized criteria the sample was divided into three groups: normal, overweight and obese. There was a significant increase in the percentage of elevated pressures from the normal to the overweight to the obese groups.

4. Education. The sample was divided into three groups: those who attended schools in the white community, those who attended boarding schools for Indians, and those who had not attended formal schools. The percentage of elevated pressures was highest in the first group and lowest in the last, the differences being statistically significant. No significant statistical association was found between blood pressure and amount of education. [871]

5. Alcoholism. Data were collected on 40 of the males as to whether they were observed by the authors to be frequently drinking or drunk, and whether or not certain key members of the community considered them to be "heavy drinkers." For purposes of analysis they were divided into two groups: [273]

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[273]
[77]

alcoholic and nonalcoholic. The alcoholics were found to have a significantly higher percentage of elevated blood pressures than the nonalcoholics.

6. Religion. Members of the sample were questioned concerning their religious affiliation and were placed into three categories: none, Christian (mostly Baptist), and Peyotists. Though there was little difference in hypertension between the Christians and those with no preference, both groups had significantly more elevated pressures than the Peyotists. Three variables did not reach the 10% level of significance.

[177]

7. Residence. Of the three Washo communities studied it was felt that Dresslerville and Carson City represented the greatest degree of acculturation to the dominant white culture, and Woodfords the least. Assuming that stress accompanies acculturation (an assumption not always warranted), we predicted that Dresslerville and Carson City would have a higher prevalence of hypertension than would Woodfords. This was in fact the case but the differences among the three communities were not statistically significant. The prevalence of elevated diastolic blood pressure was 38% in Dresslerville and 39% in Carson City, whereas it was 28% in Woodfords.

[463]

8. Occupation. Hypertension was related neither to type of occupation (ranch workers or construction workers) nor to the difference between seasonal and full time employment.

[623]

9. Involvement in Tribal Council. Past and present office holders of the Washo Tribal Council showed a tendency to have a lower percentage of elevated pressures than other Washo, but this difference did not reach a level of statistical significance.

Because it was felt that some of the associations between elevated blood pressure and selected variables might be due to relationships among variables, a correlation matrix was computed for the six significant independent variables in addition to the dependent variable, elevated blood pressure. The six variables were again found to be significantly related to blood pressure at or beyond the 10% level. Of fourteen intercorrelations, three other sets of statistically significant relationships were found: sex with age, Peyotism with alcoholism and age with school type. Since the males were found to be older than the females this difference may account for the earlier finding of a male preponderance of hypertension. The correlation between Peyotism and alcoholism is negative, and is expected, since membership in the Peyote church is supposed to preclude drinking. Finally, the correlation of age with school type (younger Washo attended the white schools, and older Washo, no school) is also expected since "integrated" schools are a relatively recent innovation in Nevada. Nonetheless, since it had already been

shown that increasing age is associated with increasing percentages of hypertension, the correlation of younger age with white schooling would tend to blur real blood pressure differences between the groups with different educational experiences. To put it another way, the finding that Washo students from white schools had more hypertension than others occurred despite the fact that these were younger Washo, whom we would normally expect to have lower pressures.

Discussion

The long standing hypothesis that stress is associated with hypertension, possibly figuring in its etiology, is supported by the data in the present study. The fact that Washo blood pressure levels are high either when compared to acceptable normal limits, or to mean levels of other societies throughout the world (for a discussion of comparisons of mean blood pressure levels of the Washo with those of a number of other groups, see Scotch, 1957, 42, 93) may be attributed under this hypothesis to the stresses to which the Washo are subject. Chief among these are poverty and the discrimination the Washo face as an extremely small minority group within the dominant white culture of Nevada. Furthermore, gainful employment is extremely difficult to get, first, because there are so few jobs available in Nevada that do not involve gambling enterprises and, secondly, because of discrimination. Further, attempts by the Bureau of Indian Affairs to alleviate the economic situation by such schemes as the relocation plan had met with complete rejection at the time of the study. To our knowledge, not a single Washo had agreed to be relocated despite the many attractive features of the plan. When Washo were interviewed concerning their reluctance to relocate, their typical attitude might be expressed:

> "Things are bad enough here where we only have to associate with whites for limited periods of time, but at least we continue to live within the tribe. We maintain many of our customs, and we know and understand our neighbors. But if we agreed to move to a new city we would be torn from our land and tribe and we would have to compete with whites on the whites' home grounds. It is better to suffer from poverty in a situation we are familiar with than to take a chance to make a decent living but live in an unfamiliar situation."

With this kind of attitude is associated a rather pessimistic world view.

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158 The stress hypothesis gains additional support from the relationship of selected variables to hypertension. The six variables found to be significantly related to hypertension represent a mixed bag. Age, sex and obesity are biological variables for the most part, whereas religion, education and alcoholism are social. This is not surprising if one accepts the current view of hypertension as a multi-causal disease. Additionally, the kinds of associations found do not necessarily imply causation. A great deal more epidemiological research must be carried out before we can begin to understand the etiology of hypertension.

With regard to the specific variables studied, the relationships between sex, age, obesity and elevated blood pressure merely support similar findings in the great bulk of studies reported for other societies. The other three variables, however, are of greater interest, particularly as regards the stress hypothesis.

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158 It has been indicated that attendance at white schools is positively as-
871 sociated with hypertension, in contrast to attendance at Indian boarding
648 schools, or no formal education at all. It can be argued that attending a white school is a stressful experience for a Washo and, extending the argument, that this stress later reflects itself in increasing blood pressure. Why is such schooling thought to be stressful? In the first place, several of those who have undergone this experience seem to feel it was. Several Washo have expressed bitterness, if not hostility, regarding the treatment they felt they received not only from the teachers of these schools but from the parents of fellow white students as well. It is of some incidental interest that in general these feelings did not extend to the white students themselves but only to their parents. This subjective evaluation of their educational experience seems warranted in the light of the objective situation. According to one white high school principal, Washo students, particularly in the past, did poorly in their studies in contrast to the white students. Furthermore, the principal corroberated the prejudiced feelings of white parents who, in his experience, had objected to the Washo's being allowed to attend the school in the first place, and have since objected to any sort of extracurricular activity that would allow the Washo to associate socially with white children. Interviews with members of the white communities of Minden and Gardnerville, the two white communities closest to Dresslerville, clearly indicate that for the most part these people do not have a high regard for the Washo and do not appreciate their attendance at the same schools. These indications seem to constitute a good case for the stressful nature of the educational experience.

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158 Alcoholic behavior can be interpreted as stressful on two counts:
273 first as a reflection of underlying psychological stresses and anxieties, and second as generating further stress in the form of reaction from white and

Washo society. In other words, the fact that particular Washo become alcoholics indicates certain personality problems of a stressful nature. Once having become alcoholics they are faced with further problems. Other Washo tend to look down on the alcoholics, who then become the subject of malicious gossip for giving a "bad name" to the Washo. In this way, alcoholism, which has been shown to be related to hypertension, may seem to reflect stress.

In contrast to education in white schools and alcoholism, membership in the Peyote cult is seen to be related to normal blood pressures, or an absence of hypertension. Here one can speculate that membership in the Peyote movement tends to be stress-reducing. The psychological and social functions of reform movements such as Peyote have long been noted. For example, Voget (1956, 259) states that these movements:

> ". . . perform a number of important functions in the continuing development and adjustment of the Indian. By providing Indians with a legitimate base for the evaluation of Indian ways, a new dignity and self-confidence emerges. The sense of inferiority and unworthiness which grips the Indian gives way to a bolder and more confident outlook, and he is enabled to face contemporary issues without immobilizing anxiety."

Our own observations among the Washo support Voget's contention. The Washo Peyotists did appear more stable and considerably less anxious than non-Peyotists. Thus the finding that the Peyotists have significantly less hypertension than the other Washo is of some interest.

On the basis of the limited data presented above it may be stated in summary that (1) variables related to social stress are also related to hypertension, and that (2) variables related to attempts to counteract such stresses are also related to an absence of hypertension. This interpretation must, of course, be considered tentative, particularly in view of the failure to find significant relationships between hypertension and some of the variables thought to be important, such as type and continuity of employment.

Studies of social factors in hypertension are currently underway in several societies throughout the world. It is hoped that findings from these studies shed additional light on the nature of the relationship of culture to this disease.